UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service

RELATION OF CHANGES IN STAPLE LENGTH OF COTTON GINNED IN THE UNITED STATES TO CHANGES IN CENTRAL MARKET PREMIUMS AND DISCOUNTS OF PRECEDING SEASONS, CROPS OF 1928-32

An Office Report
Prepared by
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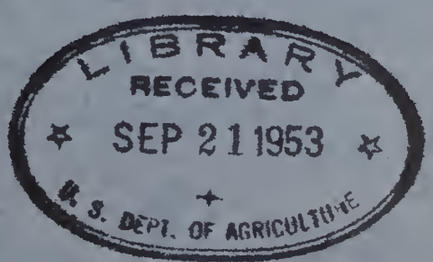
In February 1934, while they were members
of the Staff of the
Bureau of Agricultural Economics



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Introduction

Ginnings of American upland cotton from the 1931 crop amounted to 16,615,180 bales, exclusive of linters, 1/ and was the second largest crop on record, being exceeded only by that of 1926, when ginnings of upland cotton reached a total of 17,738,815 bales. 1/ Stocks of American upland cotton on hand in the United States on August 1 have greatly increased in recent years. In 1928 these stocks, according to the Bureau of the Census, amounted to 2,419,800 bales, and in 1929, to 2,122,600 bales; whereas in 1932 there were 9,560,300 bales of American upland cotton on hand in the

1/ Cotton Production in the United States, Crop of 1932, table 1, page 3, U. S. Department of Commerce, Bureau of the Census. Running bales, round bales counted as half bales.

United States on August 1. This was the largest carry-over of upland cotton on record, and that of August 1, 1933, amounting to 8,069,700 bales, 2/ was the second largest.

In view of these facts, and also in view of the fact that domestic consumption and exports are taking from the supply each year an increasingly greater proportion of the medium staple lengths, 3/ an analysis of the extent to which changes in production of certain staple lengths during the period 1928 to 1932 were associated with changes in premiums and discounts of preceding seasons is especially appropriate at this time.

Farmers as a group are inclined to produce from year to year the kind of cotton which they feel returns or will return to them the greatest net profit. Prices received by growers, therefore, or prices which they hope to receive, are obviously expected to determine in some measure the acreage planted and also the varieties of cotton grown. When prices for the longer staples are greater than those for short staples, it is to be expected that the incentive for growing cotton of longer staple length will be greater than it would be if there were no price differentials. A question which logically presents itself, then, in connection with the period studied is: To what extent were changes in the production of cotton longer than 7/8 inch and changes in the production of cotton shorter than 7/8 inch associated with changes in the premiums and discounts of preceding

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2/ According to a report of the Bureau of the Census dated August 15, 1933, showing a total carry-over of 8,164,634 bales, which included 9,826 bales of American-Egyptian cotton, 54,752 bales of Egyptian, and 30,347 bales of foreign cotton other than Egyptian.

3/ Lanham, W. B., and Weaver, O. T. Grade and Staple Length of Cotton Carried Over in the United States as Related to the Domestic Supply, 1928-29 to 1931-32, U. S. Department of Agriculture Statistical Bulletin No. 45.

seasons?

Purpose of the Analysis, and Period Studied

The primary purpose of this analysis is to show (1) the extent to which domestic production of cotton shorter than 7/8 inch in staple changed during the period studied following increases and decreases in discounts, and (2) the extent to which domestic production of certain lengths longer than 7/8 inch changed following increases and decreases in premiums. To show these relationships, a study has been made of the changes in ginnings of specified staple lengths from the crops of 1928-32 in relation to changes in average discounts at Houston, Galveston, and New Orleans and in relation to changes in average premiums at Memphis for the months of September, October, November, and December, seasons 1927-28 to 1931-32.

This period includes seasons in which premiums and discounts varied widely and during which the average annual production of upland cotton appreciably exceeded the average production during the preceding 5-year period, 1923-27. As a matter of fact, both the average production during the years 1928-32 and the average carry-over on August 1 were greater than for any preceding consecutive 5-year period in the history of cotton growing in the United States.

Production-Price Analyses

Measurement of the relationship between production and price of cotton, without particular reference to quality, 4/ has been the subject of searching inquiry for many years, and the results of analyses of this relationship have substantiated to some extent economic theories pertaining to supply and demand. They have directed specific attention to the tendencies for quantity production and price to be inversely related, for an increased crop and decline in prices to be followed by a decrease in production, and for a decreased crop and increase in prices to be followed by an increase in production. This latter relationship may be considered a corollary of the apparent effect of prices of cotton upon farmers' intentions to plant, since there is a tendency for increases and decreases in prices during the fall and winter from year to year to be associated with corresponding increases and decreases in acreage of cotton subsequently planted and harvested. 5/

4/ Beginning with 1928, the Division of Cotton Marketing, Bureau of Agricultural Economics, in compliance with the Act of March 3, 1927, Public--No. 740 -- 69 Congress, has prepared reports on the grade and staple length of the total domestic cotton crop. Similar reports were prepared by the Division on the 1927 crop for the State of Georgia and a Texas-Oklahoma area comprising 20 counties in northern Texas and 7 counties in southwestern Oklahoma. See U. S. D. A. Statistical Bulletin No. 40, page 1, footnote 2, for information relative to earlier measurements and estimates pertaining to staple length of American cotton.

5/ a. Smith, B. B. Factors Affecting the Price of Cotton. U. S. Department of Agriculture Technical Bulletin No. 50, 1928.
b. Smith, B. B. Forecasting the Acreage of Cotton. Jour. Amer. Stat. Assoc., New Series, No. 149, Vol. 20, March, 1925, pp. 31-47.
c. Harper, F. H. Forecasting the Acreage, Yield, and Price of Cotton. (Unpublished manuscript, 1928).

Quality-Price Analyses

Many qualities of upland cotton are produced each year in the United States. This cotton varies, according to government standards for grade and staple of American cotton, in staple length, from 13/16 inch and shorter to 1-1/4 inches and longer; in grade, from Good Ordinary to Middling Fair; and in color, from the stains and grays to Extra White. That part of the crop that falls below the established grades is referred to as "no grade" cotton.

Individual growers are naturally expected to be interested in producing those cottons that yield them the greatest returns over and above costs of production. The extent to which differences in grade and staple length are reflected in prices received by growers has been the subject of numerous inquiries. 6/ Measurement of the relationship between quality and prices was attempted long before the inauguration of the grade and staple reports by the Division of Cotton Marketing, and statistical interpretation of this relationship by different analysts has been responsible for the development of increasing interest in this kind of analysis.

In more recent years, studies in quality-price relationships have been facilitated by the Division's cotton classing service, which has been utilized in preparing the cotton quality reports and in reporting individual bale classifications to ginners and growers. Results that have been obtained in the Division of Cotton Marketing from the analysis of relationship between quality and price over a period of several years show that the

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6/ Among recent inquiries of this nature are those being conducted by the Division of Cotton Marketing and State agricultural colleges.

average price received by growers was generally higher in local markets where the cotton averaged higher in grade and longer in staple than in local markets where the cotton was, on the average, lower in grade and shorter in staple.

An analysis of data collected during the seasons of 1928-29, 1929-30, and 1930-31 shows wide variation, however, in the prices received by growers in local markets for cotton of the same grade and staple length on the same day. Prices received for cotton of different grades and staple lengths varied so irregularly that it was not unusual to find that prices received by some farmers for cotton of higher grade and longer staple were less than those received by other farmers for cotton of lower grade and shorter staple in the same local market on the same day. 7/

Staple-Length Improvement

Need for increasing the staple length of American cotton has been emphasized during the last decade, and especially since the preparation by the Division of Cotton Marketing of the quality reports on the 1928 and 1929 crops. Up to that time, reports from various sources indicated that there had been considerable deterioration in the quality of the domestic crop since the infestations of the boll weevil had proved so disastrous in many parts of the Cotton Belt. 8/ Even before the boll

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7/ Howell, L. D., and Burgess, J. S. Farm Prices of Cotton in Relation to its Grade and Staple Length in Local Markets in the United States, Seasons 1928-29, 1929-30, and 1930-31 (preliminary report, Nov., 1932, page 11.)

8/ The boll weevil invaded Texas in 1892, in the vicinity of Brownsville. Before a decade had passed it had become a serious pest in many cotton-producing areas.

weevil appeared in the long-staple producing areas, manufacturers had complained of a serious depreciation in the quality of cotton produced in Louisiana and Mississippi. 9/

Information from trade and other sources shows considerable agreement of opinion concerning depreciation in the quality of American cotton from most areas in the western part of the Cotton Belt during the decade ending about 1929. Depreciation in quality during this period has been stated to have taken place also in certain areas in the eastern and central parts of the Belt. In the absence of authentic record of facts regarding the extent of this depreciation, if any, these impressions had gained wide acceptance up to the time of the inauguration of the grade and staple-length reports in 1928. The extent to which these impressions were justified can never be accurately ascertained.

Official figures show, however, that both the quantity and the proportion of cotton shorter than 7/8 inch ginned from the 1929 crop were much greater than ginnings of these lengths from the 1928 crop. Attention was directed to this increased production of short cotton, and during the 1930-31 season ginnings of cotton shorter than 7/8 inch were less than those from the 1928 crop. It is an important fact that there has been a distinct increase in average length of staple since 1928.

9/ Cook, O. F. Cotton Problems in Louisiana. Bureau of Plant Industry Circular No. 130-A, June 21, 1913, page 5. See also Department of Agriculture Bulletin No. 60, entitled "The Relation of Cotton Buying to Cotton Growing", by O. F. Cook, February 16, 1914, pages 1 and 11. Official figures on grade and staple-length distribution are not available for crops earlier than that of 1928 (see footnote 4). Grade and staple-length reports are issued periodically during the ginning season and at the end of the season. Beginning with the 1932-33 season, weekly reports have been prepared showing proportionate distribution of samples classed among the different grades and staple lengths. Beginning with the 1938-39 season weekly reports were discontinued and semi-monthly reports were inaugurated. Monthly reports were discontinued at the end of the 1938-39 season.

The reports showing the number of bales and the proportions of each individual grade and staple-length group reflect the changes that have taken place since 1928 in the grade and staple length of American cotton produced. Although this period is probably too short to indicate long-time trends, certain important changes that seem to indicate tendencies have taken place since the inauguration of the grade and staple reports. Since 1929 there has been a decrease in the American crop in both the number of bales of cotton shorter than 7/8 inch and in the proportion that cotton of these lengths constitutes of total ginnings. There has been no appreciable change in the proportion of 7/8-inch cotton. The decrease in production of the lengths shorter than 7/8 inch has been accompanied by marked increases, on the whole, in the production of certain of the lengths longer than 7/8 inch, and there has resulted an appreciable increase in the average length of staple for the United States.

It has been the responsibility of the Division of Cotton Marketing to class representative portions of the crop and to prepare statistics showing the number of bales of the different grades and staple lengths ginned. These statistics have been presented for individual states and for subdivisions thereof. The extent to which average staple length has increased since the inauguration in 1928 of the reports on quality of the entire crop is indicated by the decrease in production of cotton shorter than 7/8 inch and by the increase in production of certain of the staple lengths longer than 7/8 inch.

These changes have probably resulted from a great many influencing factors. Differences in seasons have probably contributed to these changes, but it would hardly seem logical to attribute all the changes from year to

year to this one factor alone. The Extension Service in many of the States has promoted the planting of better seed, as have also breeders, farmers' organizations, and others.

Particular attention has been directed by the Bureau of Plant Industry to the establishment of one-variety communities, and efforts in this direction have been quite successful in some parts of the Belt. The cooperating marketing associations throughout the Belt have been able to obtain differences in price for different staple lengths, and this, too, has probably proven to be an effective incentive for the farmer to improve his cotton. All of these factors probably influenced, either directly or indirectly, the increases that took place in average staple length of the crops of 1928 to 1932, inclusive, and it would be difficult, if not impossible, to determine the effect of each. It is important to know, however, that changes in premiums and discounts have been followed by changes in staple-length distribution of production, resulting in appreciable increases in average length of staple.

Relation of Premiums and Discounts to Staple Lengths Subsequently Produced

In studying the relationship between premiums and discounts and the proportions of certain staple lengths ginned during subsequent seasons, measurements have been made to show, for the period studied, the extent to which production of cotton shorter than 7/8 inch in staple varied with preceding discounts, and the extent to which production of certain lengths longer than 7/8 inch varied with preceding premiums. The measurement of these relationships was made by the application of simple correlation procedure and by the construction of scatter diagrams, upon which there

were superimposed the lines of regression showing highest average relationships between discounts and subsequent production of cotton shorter than 7/8 inch and between premiums and subsequent production of certain lengths longer than 7/8 inch. 10/

Average monthly discounts on Middling 13/16-inch cotton at Houston, Galveston, and New Orleans, expressed as percentages of the average price for Middling 7/8-inch cotton at these markets, are shown in table 1 for the seasons 1927-28 to 1931-32. Average monthly premiums on Middling cotton of the lengths 15/16 inch to 1-1/4 inches at Memphis, expressed as percentages of the average price for Middling 7/8-inch cotton at ten markets, are shown in table 2 for the same period.

In table 3 figures are presented showing the number of bales of upland cotton of each specified staple-length group that was ginned from the crops of 1928 to 1932, inclusive. Proportionate distribution of these ginnings among the different staple-length groups is indicated by the percentages shown in table 4. These figures reflect the changes that took place during the 5-year period, 1928-32, in the quantities and proportions of the different lengths ginned. It will be observed that both the quantity and the proportion of cotton shorter than 7/8 inch greatly decreased after 1929, and that the quantities and proportions of certain of the lengths longer than 7/8 inch increased appreciably after that year. 11/

10/ Coefficients of correlation were calculated by the Pearsonian method.
11/ The official cotton standards for length of staple were revised in 1929, the revision becoming effective August 1 of that year.

Farmers as a group generally market the greater part of their cotton at the time of ginning or soon thereafter. During the 5-season period studied, 1927-28 to 1931-32, inclusive, the proportion of the crop marketed by farmers during the months of September, October, and November varied from 58 percent to 67 percent; and during the same period the proportion marketed during the four months of September, October, November, and December varied from 71 percent to 79 percent. 12/ To the extent that premiums and discounts for these months were an incentive to the production of longer staple lengths, their relationship to changes in staple-length distribution would be expected to be reflected in subsequent crops.

The degree to which average discounts for specified months of the seasons 1927-28 to 1931-32 were inversely related to proportionate ginnings of cotton shorter than 7/8 inch from the subsequent crops of 1928-32 is indicated by the coefficients of correlation and determination presented in table 5. 13/ It would seem logical to assume that some causal relationship exists for the period studied between discounts and changes in production of cotton shorter than 7/8 inch in staple.

Coefficients of correlation and determination derived from the analysis of changes in premiums in relation to subsequent changes in production of certain staple lengths longer than 7/8 inch are presented in table 6 for 3-month and 4-month periods of the seasons 1927-28 to 1931-32. 13/ Despite the fact that the period is not of sufficient length

12/ According to reports of the Division of Crop and Livestock Estimates.

13/ When there is a causal relationship, the coefficient of determination, or the square of the coefficient of correlation, is often convenient in indicating the extent to which variability in one series of items is influenced or determined by variability in another series.

to indicate definite long-time trends, the figures seem to indicate that, in most instances, increases in premiums may have been responsible for a part of the changes in production of some of the longer staple lengths in subsequent years.

Figures 1 to 5 14/ portray the relationships described as having existed between premiums and discounts for the seasons 1927-28 to 1931-32 and staple-length distribution of ginnings during subsequent seasons from the crops of 1928-32.

In figure 1 there is portrayed the relationship between average discounts for September, October, and November of the five seasons, 1927-28 to 1931-32, and ginnings of cotton shorter than 7/8 inch from the crops of 1928-32. There appears to have been a marked tendency for a change in discounts for cotton shorter than 7/8 inch to be followed the next season by a change in the opposite direction in the proportionate ginnings of cotton shorter than 7/8 inch. This relationship is rather consistent for the period studied, the changes for individual years deviating very little, on the whole, from the line of highest average relationship.

The relationships between premiums for cotton of the lengths 15/16 inch to 1-1/8 inches and ginnings of these lengths are presented in figures 2 to 5. These relationships show that during the period studied there was a marked tendency, on the whole, for an increase or decrease in premiums for these lengths to be followed the next season by a change in the same direction in proportionate ginnings.

14/ Each figure is to be interpreted individually. Note differences in scale used in constructing these figures.

Figure 2 presents the relationship between premiums for Middling 15/16-inch cotton and subsequent ginnings of cotton of this length group from the crops of 1928-32. As will be observed, this relationship is rather inconsistent, as indicated by the extent to which individual changes deviate from the line of highest average relationship.

Figures 3 and 4 present the relationships between premiums for Middling cotton of the lengths 1 inch and 1-1/16 inches and subsequent ginnings of cotton of these lengths from the crops of 1928-32. For the 5-year period as a whole, these relationships are rather consistent. Changes for the individual years do not deviate greatly from the line of highest average relationship for the 5-year period.

The relationship between premiums for Middling cotton 1-1/8 inches in staple and subsequent ginnings of cotton of this length from the crops of 1928-32 is portrayed in Figure 5. This relationship does not seem to be as consistent as that shown for changes in premiums for cotton of the lengths 1 inch and 1-1/16 inches and subsequent changes in ginnings of cotton of these length groups. The inconsistency in relationship is indicated by the extent of deviation of individual changes from the line representing highest average relationship.

During the 5-year period studied, the proportion of the various crops that was 7/8 inch in staple varied but little from year to year. The decrease in the proportion of cotton shorter than 7/8 inch was compensated for by increases in several of the staples longer than 7/8 inch. The increase in the proportion of cotton longer than 7/8 inch, divided up among several lengths, would not be expected to be as pronounced as the decrease in the one staple-length group embracing staples shorter than 7/8 inch.

Table 1.- Average monthly discounts for 13/16-inch cotton at Houston, Galveston, and New Orleans, expressed in percentages of price for Middling 7/8-inch cotton, 1927-28 to 1931-32 1/

Month	Season				
	1927-28	1928-29	1929-30	1930-31	1931-32
	Percent	Percent	Percent	Percent	Percent
August	3.9	2.7	4.1	8.8	11.0
September	3.5	2.8	4.1	9.6	9.9
October	3.6	2.7	5.6	10.0	8.5
November	5.0	3.4	7.3	9.6	6.3
December	6.5	3.4	8.9	10.6	5.6
January	6.7	3.9	8.9	10.3	4.1
February	5.7	3.9	8.2	9.1	3.8
March	5.3	3.8	6.7	9.1	4.5
April	5.0	3.9	6.4	9.7	4.3
May	4.8	4.1	6.5	9.0	2.7
June	3.6	4.1	7.5	10.1	4.9
July	3.5	4.1	8.1	9.6	4.4

1/ Compiled from office records of the Cotton Price Quotations and News Service of the Division of Cotton Marketing. Percentages were calculated by dividing average discounts by the average price for Middling 7/8-inch cotton at the three markets.

Table 2.- Average monthly premiums at Memphis, expressed in percentages of price for Middling 7/8-inch cotton, for the lengths 15/16 inch to 1-1/4 inches, 1927-28 to 1931-32 1/

15/16 inch

Month	Season				
	1927-28	1928-29	1929-30	1930-31	1931-32
	Percent	Percent	Percent	Percent	Percent
August	3.9	1.3	3.8	3.3	6.1
September	5.9	1.8	2.7	2.5	6.0
October	3.7	2.5	3.1	3.6	2.4
November	3.8	2.1	3.2	4.5	1.8
December	3.2	2.1	3.0	4.9	3.1
January	2.7	2.1	3.0	4.8	2.9
February	2.0	2.1	3.3	4.4	2.3
March	1.9	2.4	3.5	4.4	2.3
April	1.8	2.6	4.1	4.3	2.6
May	1.7	2.7	3.3	4.6	2.8
June	1.3	3.4	3.4	4.8	2.0
July	1.2	4.1	3.7	4.6	1.8

1 inch

Month	Season				
	1927-28	1928-29	1929-30	1930-31	1931-32
	Percent	Percent	Percent	Percent	Percent
August	6.5	4.0	9.9	8.1	13.7
September	5.9	4.2	8.2	7.8	12.9
October	6.1	4.4	6.8	11.2	6.6
November	6.3	4.3	7.1	10.9	6.9
December	5.5	4.2	7.5	11.2	6.9
January	5.4	4.5	7.6	10.7	6.5
February	4.3	5.8	8.3	9.9	6.2
March	4.0	5.9	8.5	9.8	7.0
April	3.8	7.1	8.1	9.8	7.7
May	3.6	7.4	6.8	10.3	8.3
June	3.6	8.7	7.5	10.7	6.0
July	3.5	10.1	8.2	10.4	5.4

Table 2.- Continued

1-1/16 inches

Month	Season				
	1927-28	1928-29	1929-30	1930-31	1931-32
	Percent	Percent	Percent	Percent	Percent
August	9.1	6.7	13.0	13.9	22.8
September	7.1	7.8	12.2	14.2	23.5
October	7.9	9.2	11.4	15.9	16.4
November	7.6	8.8	11.9	16.8	15.3
December	7.9	7.6	11.7	16.4	13.8
January	9.0	8.6	10.3	16.0	13.0
February	8.5	10.3	11.6	14.8	15.1
March	5.9	10.1	12.3	14.8	15.3
April	5.4	11.6	9.7	16.3	15.4
May	6.1	13.4	10.9	19.0	16.6
June	6.0	13.9	12.8	17.8	12.0
July	5.9	15.0	12.3	17.3	13.5

1-1/8 inches

Month	Season				
	1927-28	1928-29	1929-30	1930-31	1931-32
	Percent	Percent	Percent	Percent	Percent
August	17.0	10.7	16.9	16.6	30.4
September	17.1	11.3	13.9	21.6	34.3
October	16.2	10.8	12.8	20.4	30.4
November	17.7	10.2	14.0	19.8	29.4
December	15.8	9.5	14.7	21.8	27.0
January	15.5	11.6	13.3	19.7	24.4
February	14.2	14.0	15.8	18.6	25.0
March	12.8	13.9	17.0	17.0	22.7
April	10.1	16.2	13.0	21.7	23.2
May	9.7	17.6	15.2	24.7	25.0
June	9.6	17.7	15.6	23.8	20.0
July	9.4	19.1	14.3	23.1	18.0

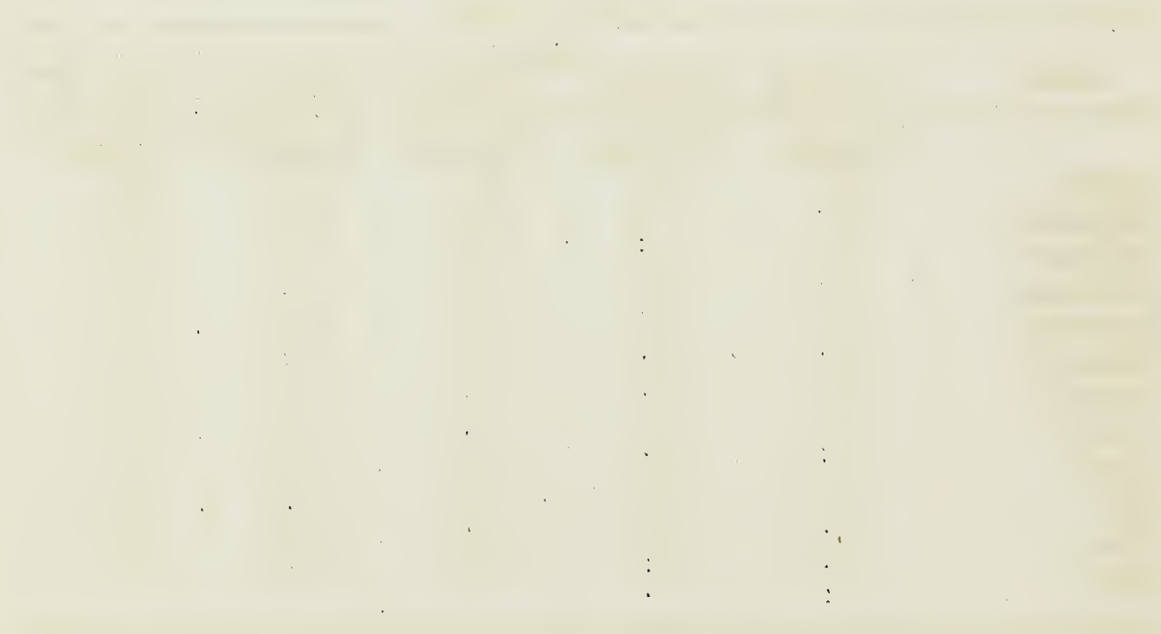


Table 2.- Continued

1-3/16 inches

Month	Season				
	1927-28	1928-29	1929-30	1930-31	1931-32
	Percent	Percent	Percent	Percent	Percent
August	30.0	16.0	21.3	30.1	45.7
September	27.8	16.2	18.8	36.4	53.7
October	24.1	14.6	17.0	33.1	45.2
November	22.2	13.9	19.7	32.2	41.0
December	21.1	12.5	22.2	35.5	38.9
January	22.2	15.9	20.5	34.7	36.6
February	19.9	18.6	22.6	32.1	36.1
March	18.1	17.7	24.2	32.0	35.4
April	15.2	22.1	21.1	34.8	36.0
May	14.0	25.0	23.5	36.2	37.9
June	14.4	23.5	27.0	35.6	30.1
July	14.1	23.2	26.6	34.6	27.1

1-1/4 inches

Month	Season				
	1927-28	1928-29	1929-30	1930-31	1931-32
	Percent	Percent	Percent	Percent	Percent
August	49.6	24.0	40.2	70.7	106.5
September	46.0	26.8	33.6	84.3	109.4
October	30.5	31.2	32.6	76.4	84.4
November	30.4	32.1	35.2	73.7	78.8
December	27.0	28.8	38.7	79.2	71.4
January	32.0	30.5	39.6	77.4	56.9
February	34.1	35.0	44.7	71.6	56.7
March	30.4	37.9	45.8	71.4	57.1
April	22.8	40.9	42.2	77.0	61.8
May	21.3	48.3	43.3	82.2	65.6
June	21.6	43.6	49.7	83.1	60.1
July	21.2	45.1	62.5	80.3	54.2

1/ Compiled from office records of the Cotton Price Quotations and News Service of the Division of Cotton Marketing. Percentages were calculated by dividing average premiums at Memphis by the average price for Middling 7/8-inch cotton at ten markets (Norfolk, Augusta, Savannah, Montgomery, New Orleans, Memphis, Little Rock, Dallas, Houston, and Galveston).

Table 3.- Ginnings of American upland cotton in the United States, by staple length, crops of 1928-32 1/

(Quantities are given in running bales, except that round bales are counted as half bales)

Staple-length group (inches)	Crop year				
	1928	1929	1930	1931	1932 2/
	1,000 bales	1,000 bales	1,000 bales	1,000 bales	1,000 bales
Shorter than 7/8	2,072.1	2,921.5	1,829.2	1,019.5	826.4
7/8 and 29/32	5,914.8	5,533.7	5,327.7	6,593.3	4,781.4
15/16 and 31/32	3,225.7	2,748.2	3,421.6	4,511.9	3,675.8
1 and 1-1/32	1,575.8	1,693.6	1,725.9	2,557.1	1,823.0
1-1/16 and 1-3/32	794.2	938.6	970.9	1,087.8	873.6
1-1/8 and 1-5/32	489.2	556.1	393.3	590.0	623.6
1-3/16 and 1-7/32	167.9	119.4	60.8	224.6	85.4
1-1/4 and longer	28.5	7.9	2.8	31.0	5.8
Total	14,268.2	14,519.0	13,732.2	16,615.2	12,695.0

1/ Figures showing distribution by staple length for 1928, 1929, 1930, and 1931 compiled from U. S. Department of Agriculture Statistical Bulletin No. 40, pages 4, 17, 31, and 41. Figures showing distribution by staple length for 1932 compiled from U. S. Department of Agriculture grade and staple report of April 14, 1933. Figures on total ginnings for 1928, 1929, 1930 and 1931 are as reported by the Bureau of the Census in Cotton Production in the United States, crop of 1932; figures in a preliminary release dated March 20, 1933.

2/ Preliminary. (See footnote 1.)

Table 4.- Percentage distribution of American upland cotton ginned in the United States, by specified staple-length groups, crops of 1928-32 1/

Staple-length group (inches)	Crop year				
	1928	1929	1930	1931	1932
	Percent	Percent	Percent	Percent	Percent
Shorter than 7/8	14.5	20.1	13.3	6.1	6.5
7/8 and 29/32	41.5	38.1	38.8	39.7	37.7
15/16 and 31/32	22.6	18.9	24.9	27.2	28.9
1 and 1-1/32	11.0	11.7	12.6	15.4	14.4
1-1/16 and 1-3/32	5.6	6.5	7.1	6.5	6.9
1-1/8 and 1-5/32	3.4	3.8	2.9	3.5	4.9
1-3/16 and 1-7/32	1.2	.3	.4	1.4	.7
1-1/4 and longer	.2	.1	2/	.2	2/
Total	100.0	100.0	100.0	100.0	100.0

1/ Based on data shown in table 3.
2/ Less than 0.05 percent.

Table 5.- Coefficients of correlation and determination indicating the relationship between average discounts for Middling 13/16-inch cotton and the subsequent season's ginnings of cotton shorter than 7/8 inch from the crops of 1928-32

Period to which discounts relate 1/	Coefficient of correlation 2/	Coefficient of determination 3/
September, October, November, and December	-.941	.885
September, October, and November	-.965	.931

1/ Seasons 1927-28 to 1931-32.

2/ Calculated by the Pearsonian method from the data presented in tables 1 and 4. No correction was made for smallness of sample in calculating the standard deviations, the number of observations used being all that could be made available for the analysis, and not merely a sample of such observations. The n - 2 correction was made, however, in applying Dr. Fisher's formula in the evaluation of significance of the coefficients.

3/ Square of the coefficient of correlation. By moving the decimal points two places to the right, percentages are obtained that indicate the extent to which changes in discounts are reflected in the opposite direction in the proportionate ginnings of short cotton.

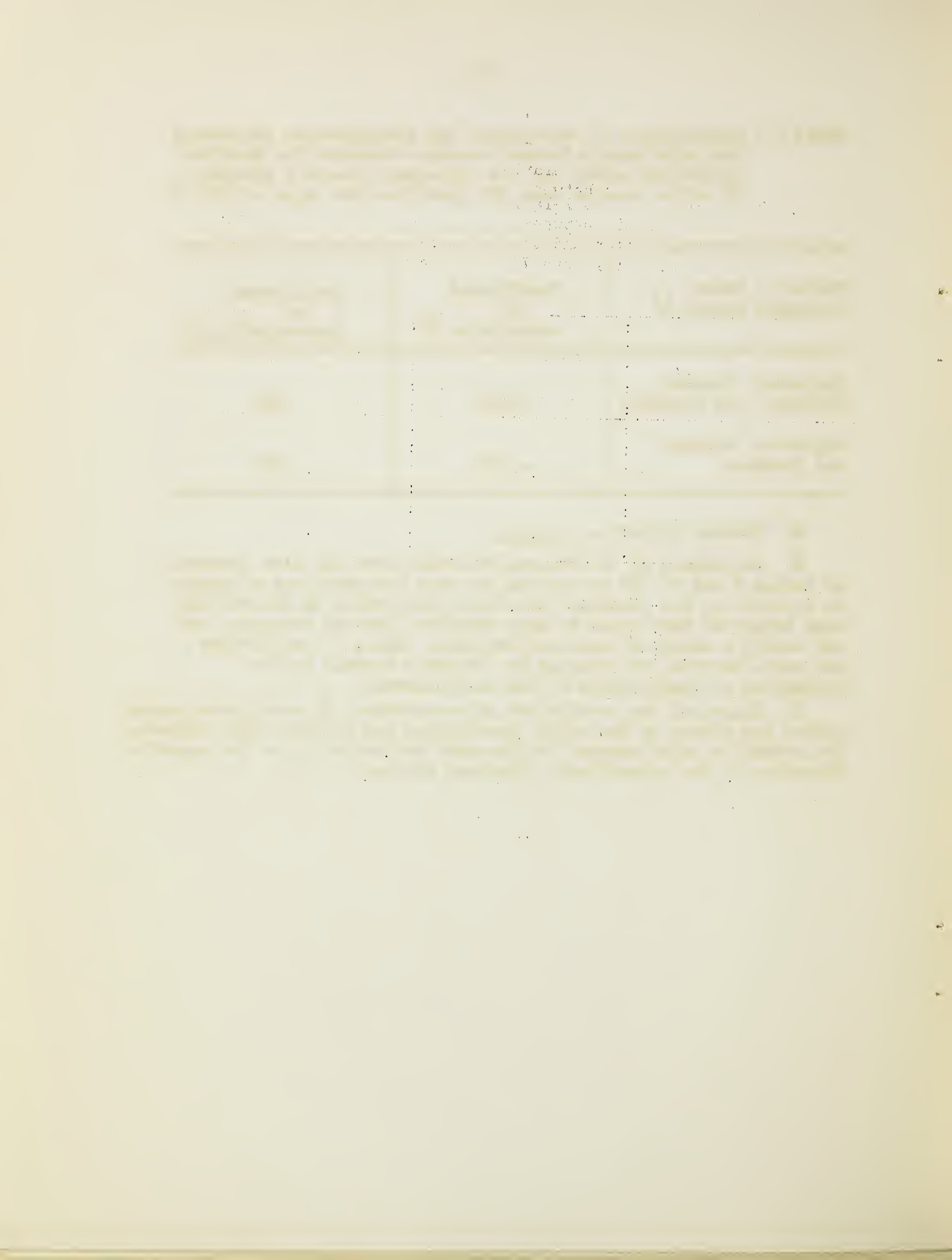


Table 6.- Coefficients of correlation and determination indicating the relationship between average premiums for Middling cotton of specified staple lengths and the subsequent season's ginnings of cotton of these lengths from the crops of 1928-32

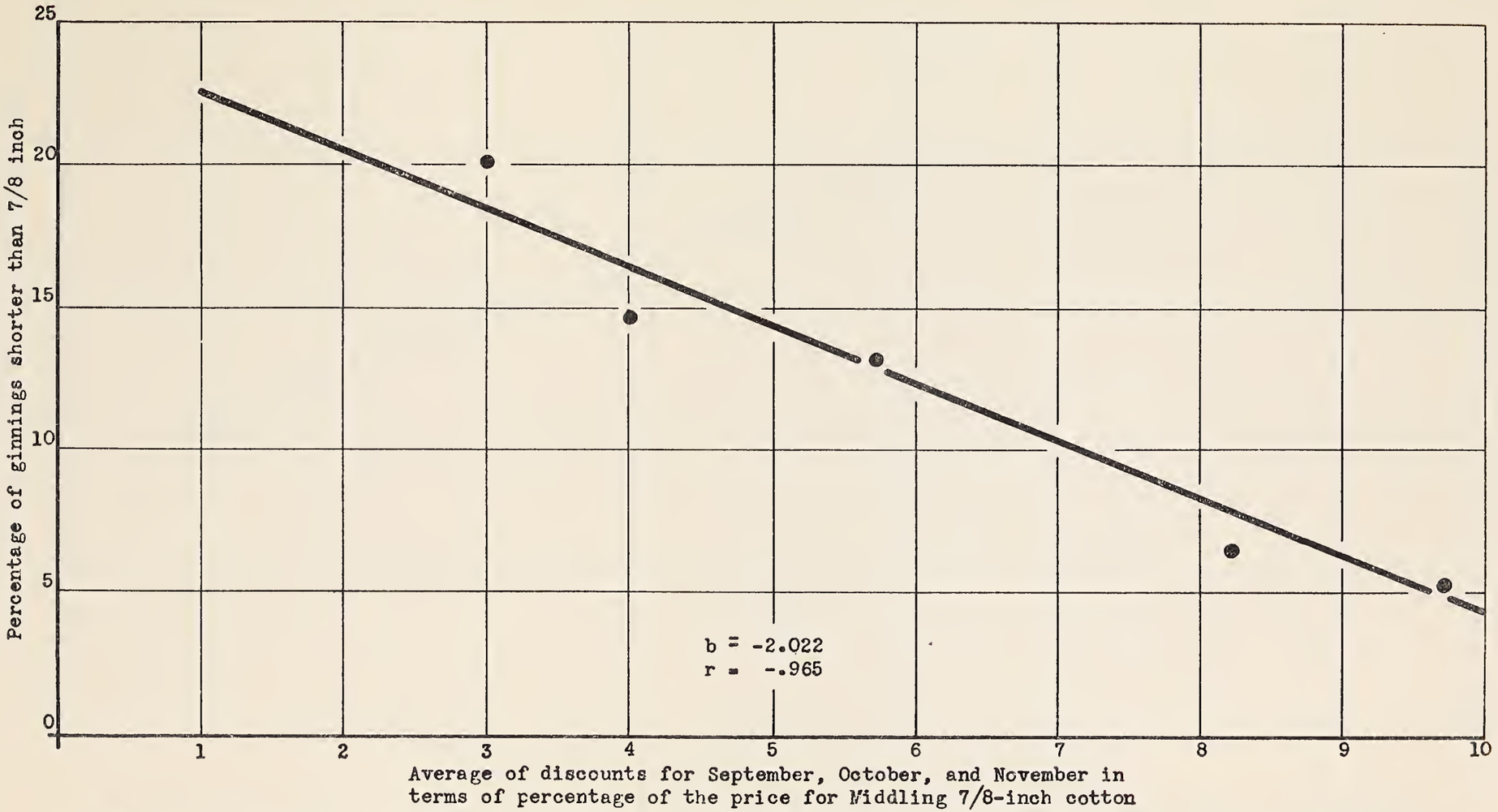
Period to which premiums relate 1/	Coefficient of correlation 2/				Coefficient of determination 3/			
	15/16 inch	1 inch	1-1/16 inches	1-1/8 inches	15/16 inch	1 inch	1-1/16 inches	1-1/8 inches
September, October, November, and December	.507	.899	.590	.747	.257	.808	.348	.558
September, October, and November	.386	.899	.602	.778	.149	.808	.362	.605

1/ Seasons 1927-28 to 1931-32

2/ Calculated by the Pearsonian method from the data in tables 2 and 4. No correction was made for smallness of sample in calculating the standard deviations, the number of observations used being all that could be made available for the analysis, and not merely a sample of such observations. The n - 2 correction was made, however, in applying Dr. Fisher's formula in the evaluation of significance of the coefficients.

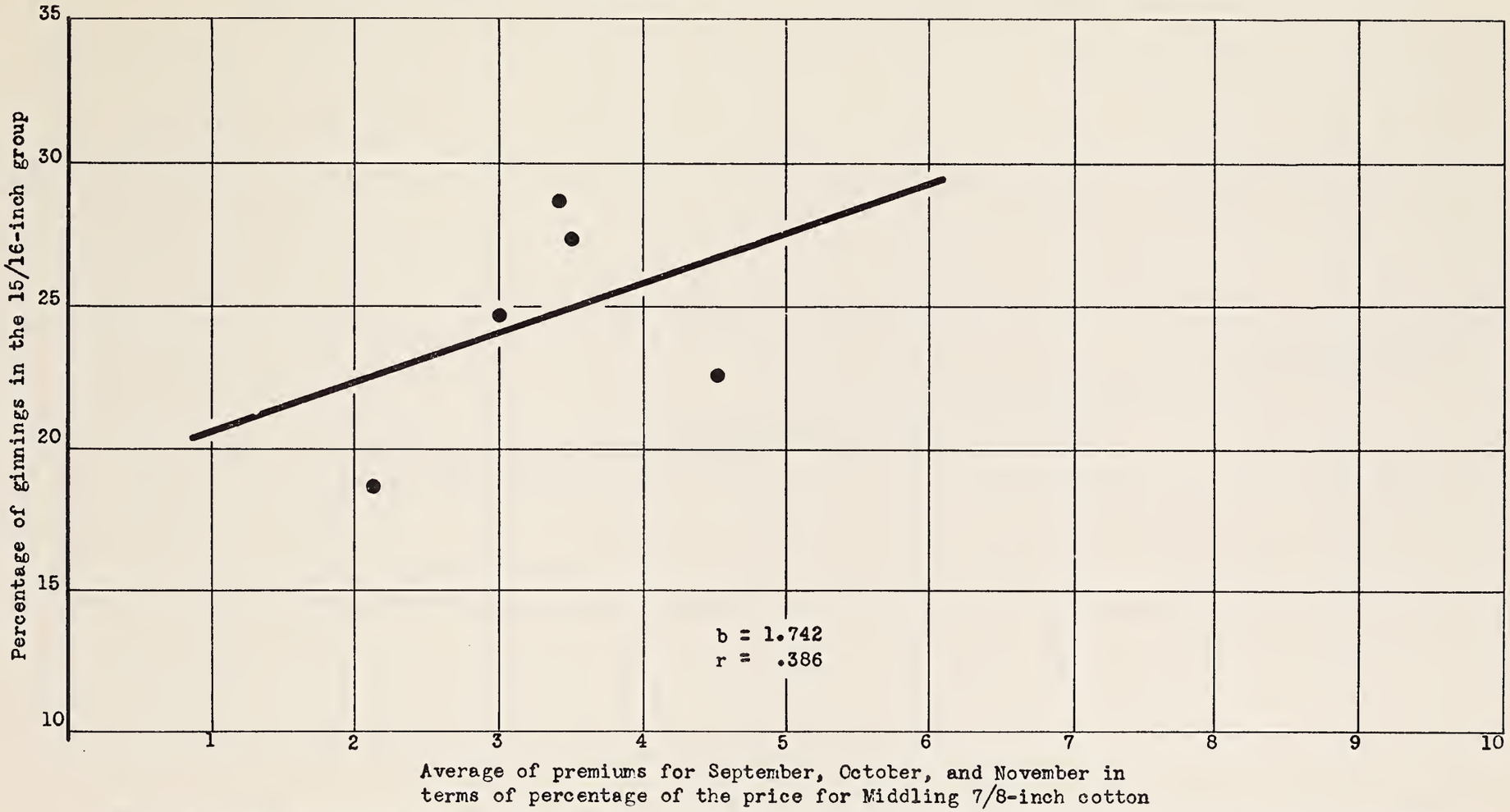
3/ Square of the coefficient of correlation. By moving decimal points two places to the right, percentages are obtained that indicate the extent to which changes in premiums are reflected in the same direction in the proportionate ginnings of the longer lengths referred to.

Figure 1.- Relation between average central market discounts for September, October, and November for Middling 13/16-inch cotton at Houston, Galveston, and New Orleans, seasons 1927-28--1931-32, and subsequent seasons' ginnings of cotton shorter than 7/8 inch, crops of 1928-32



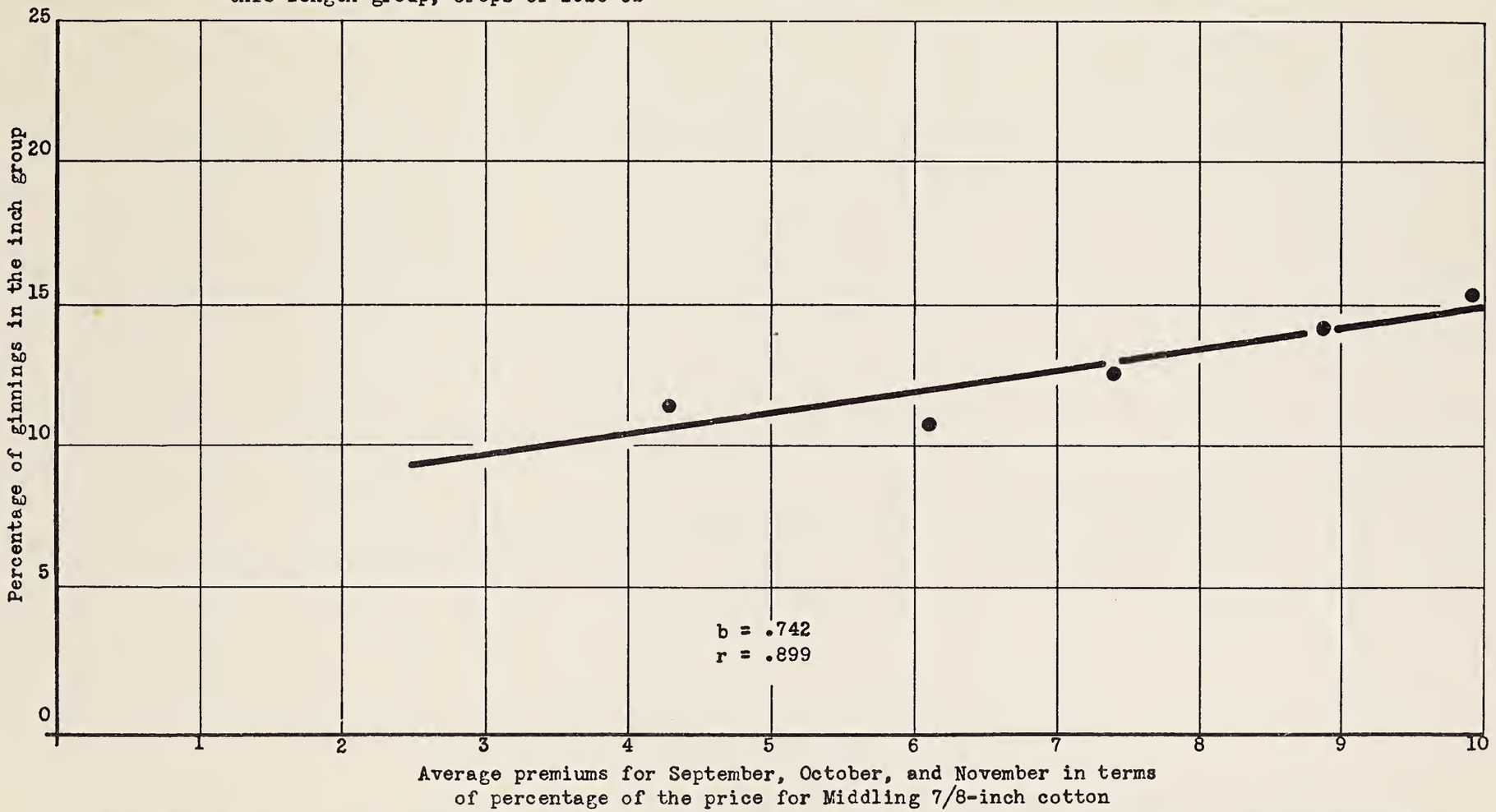
The relationship between average discounts and subsequent ginnings of cotton shorter than 7/8 inch shows that there was a marked tendency for a change in discounts to be followed in the next season by a change in the opposite direction in the proportion of cotton shorter than 7/8 inch ginned. This tendency toward inverse relationship is rather consistent for the period represented (Tables 1, 4, and 5.)

Figure 2.- Relation between average central market premiums for September, October, and November for Middling 15/16-inch cotton at Memphis, seasons 1927-28--1931-32, and subsequent seasons' ginnings of cotton of this length group, crops of 1928-32



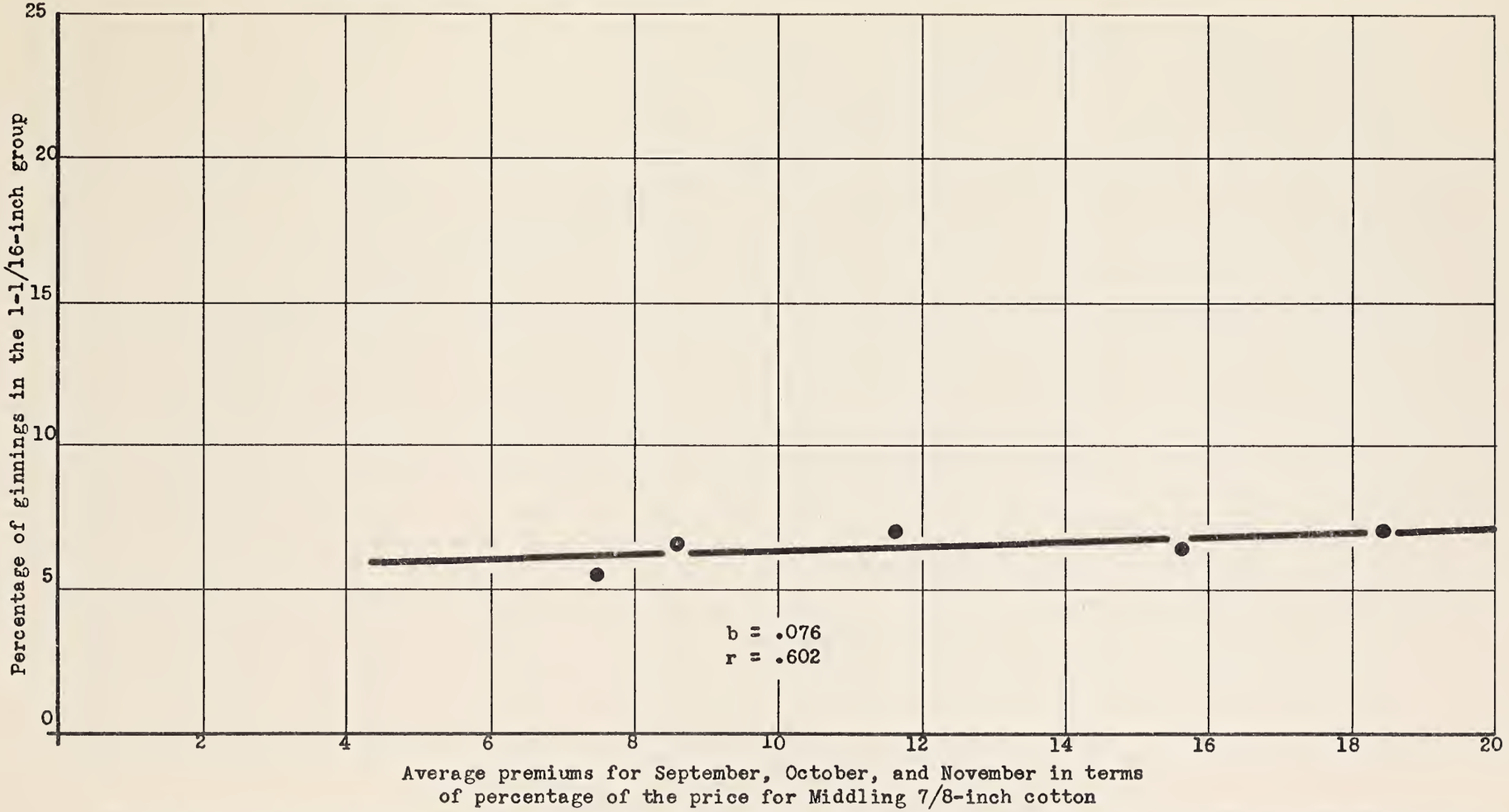
For the 5-year period as a whole there was a positive relationship between premiums and ginnings of the following season, there having been a tendency for a change in premiums to be followed the next season by a change in the same direction in proportionate ginnings of cotton of the 15/16-inch group. The relationship, however, was rather inconsistent, as indicated by the deviations of changes from the line of highest average relationship (tables 2, 4, and 6.)

Figure 3.- Relation between average central market premiums for September, October, and November for Middling inch cotton at Memphis, seasons 1927-28--1931-32, and subsequent seasons' ginnings of cotton of this length group, crops of 1928-32



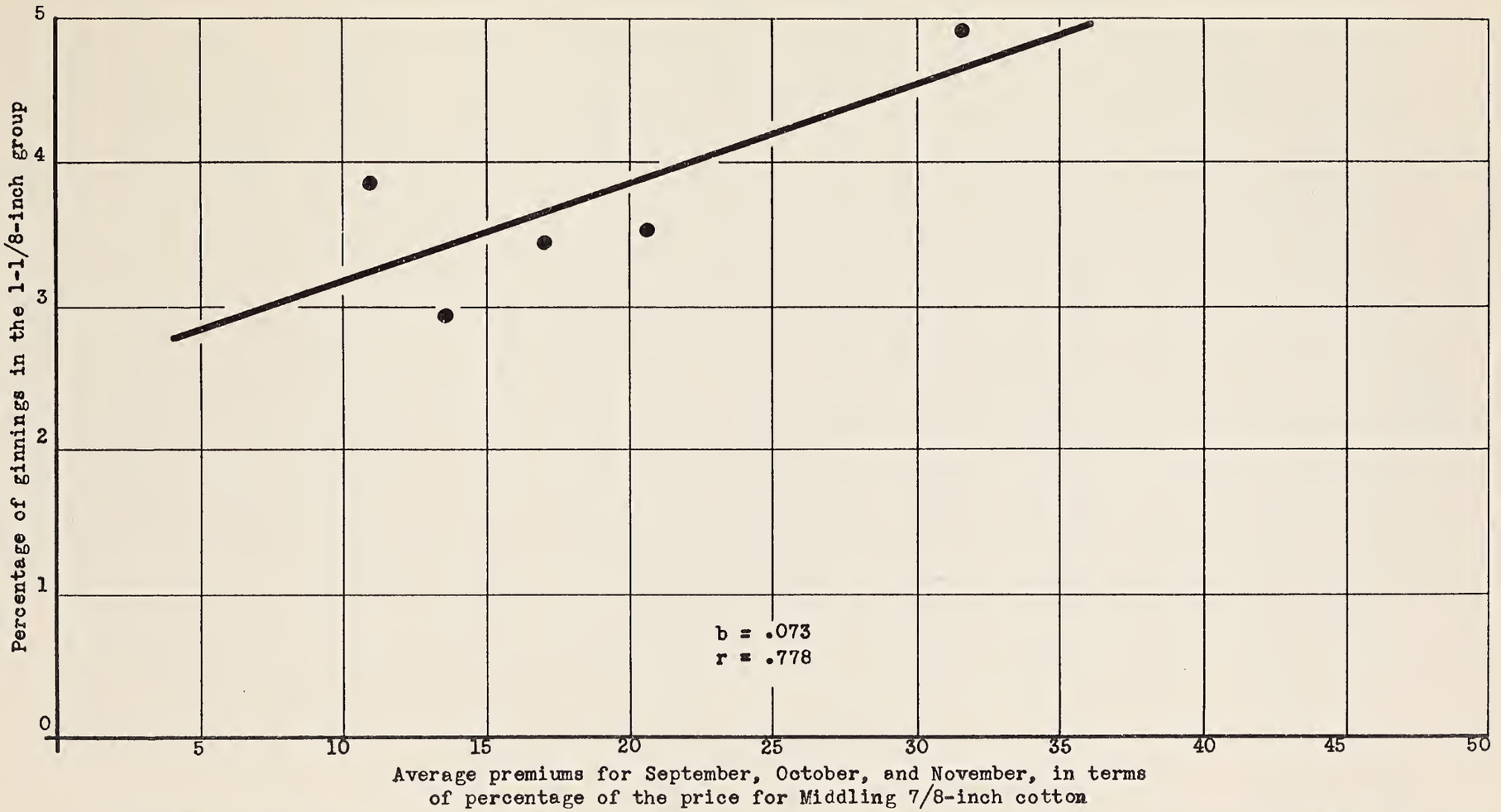
There was a consistent tendency in the relationship between premiums and ginnings, changes in premiums having been followed, for the period as a whole, by changes in the same direction in the proportions of inch cotton ginned during subsequent seasons. Changes for any individual year did not deviate to any great extent from the line of highest average relationship for all years. (Tables 2, 4, and 6.)

Figure 4.- Relation between average central market premiums for September, October, and November for Middling 1-1/16 inch cotton at Memphis, seasons 1927-28--1931-32, and subsequent seasons' ginnings of cotton of this length group, crops of 1928-32



For the period as a whole there was a consistent tendency for changes in premiums to be followed by changes in the same direction in the proportions of 1-1/16 inch cotton ginned during subsequent seasons. Changes for individual years approximated very closely the average changes represented by the line of relationship for the 5-year period.

Figure 5.- Relation between average central market premiums for September, October, and November for Middling 1-1/8-inch cotton at Memphis, seasons 1927-28--1931-32, and subsequent seasons' ginnings of cotton of this length group, crops of 1928-32



There was a tendency during the 5-year period for changes in premiums to be followed by changes in the same direction in the proportions of 1-1/8-inch cotton ginned during subsequent seasons. The relationship, however, was not as consistent as that which existed between changes in premiums for cotton of the lengths 1 inch and 1-1/16 inches and subsequent changes in proportionate ginnings.

SUMMARY

1. Both the quantity and the proportion of cotton shorter than 7/8 inch decreased markedly after 1929, and the quantities and proportions of most of the staples longer than 7/8 inch increased considerably after that year.

2. An appreciable increase in the average length of staple for the United States as a whole resulted from changes that took place in staple-length distribution of production during the period 1929 to 1932. These changes consisted of a decrease in the production of cotton shorter than 7/8 inch in staple and an increase in the production of certain staples longer than 7/8 inch, principally 15/16 inch to 1-1/8 inches.

3. Changes in production of cotton shorter than 7/8 inch during the period 1928-32 were inversely related, on the whole, to discounts of preceding seasons, whereas changes in production of lengths longer than 7/8 inch, principally 15/16 inch to 1-1/8 inches, were positively related, on the whole, to premiums of preceding seasons. That is, there was a tendency for changes in production of cotton shorter than 7/8 inch to move in the opposite direction from preceding changes in discounts, and for changes in production of cotton of the longer lengths to move in the same direction as changes in premiums of preceding seasons.

4. The analysis indicates that during the period 1928-32 changes in production of cotton shorter than 7/8 inch and changes in production of lengths longer than 7/8 inch, principally 15/16 inch to 1-1/8 inches, were influenced, to the extent that relationships were causal, by changes in premiums and discounts of preceding seasons.

Significance of Relationships

Statistical appraisal of the probability of occurrence of the observed correlations purely by chance has been made by using the formula $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$. Results obtained from the use of this formula indicate that, on the whole, significance is to be attached to the calculated measures of relationship, but it is apparent that factors other than those considered in this study contributed to the causes for changes in staple-length distribution of production.

The equation used in appraising the probability of occurrence of the observed correlations purely by chance was developed by Dr. R. A. Fisher for testing the significance of correlation coefficients obtained from small samples, and it has been found useful in this study. 15/ Interpretation of the measures of relationships was facilitated by reference to a chart presented by Dr. M. J. B. Ezekiel in his text on "Methods of Correlation Analysis" (page 392), which is so constructed as to make it possible to read direct the probability of occurrences solely by chance, and by reference to a table presented on page 20 of the text. 16/

Table 7 presents the measures of indicated probability along with the calculated coefficients of correlation and the derived t values. As will be observed, the P values are quite indicative of significance of

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15/ Fisher, R. A. Statistical Methods for Research Workers, 2nd. ed., pp. 159-162, and 4th ed., pp. 171-174. See also a discussion by Dr. M. J. B. Ezekiel in his "Methods of Correlation Analysis," page 256.

16/ This chart and table are based upon the results given by "Student" in his article on New Tables for Testing the Significance of Observations (Metron, V, No. 3, pp. 105-120, 1925.)

relationship between discounts and subsequent ginnings of 13/16-inch cotton and, on the whole, they indicate that considerable significance is to be attached to the relationship between premiums and subsequent ginnings of specified lengths above 15/16 inch.

The calculated probabilities for 15/16-inch cotton, for which the coefficients of correlation are smaller than for any other staple length represented, indicate that the observed correlation is less significant than that for any other specified staple length. This is indicated by the lack of consistency in the degree of relationship between changes in premiums for cotton of this length and changes in subsequent production. Because of this lack of consistency, the significance that might otherwise have been attached to the results is minimized, in spite of the relatively large b value representing the slope of the line of highest average relationship. This relatively large b value was obtained principally because the standard deviation of the series of percentages representing premiums was very small in relation to the standard deviation of the series of percentages representing production, and not because the coefficient of correlation was large.

Table 7.- Probabilities of significance of coefficients of correlation indicating relationship between changes in staple-length distribution of cotton production, 1928-32, and changes in premiums and discounts of preceding seasons

Staple length (inches)	Measures based on changes in production and changes in premiums and discounts for September, October, November, and December			Measures based on changes in production and changes in premiums and discounts for September, October, and November		
	r 1/	t 2/	P 3/	r 1/	t 2/	P 3/
13/16	-.941	4.82	.017	-.965	6.37	4/
15/16	.507	1.02	.385	.386	.72	.537
1	.899	3.55	.038	.899	3.55	.038
1-1/16	.590	1.27	.304	.602	1.31	.292
1-1/8	.747	1.95	.148	.778	2.14	.125

1/ Adapted from tables 5 and 6. Calculated from basic data in tables 1, 2, and 4.

2/ $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$. The t values are used to judge the probabilities of the occurrence of correlation purely by chance. The effect of a larger r on the size of t is indicated.

3/ In reading from the probability table, 4 (or 5 - 1) was used as n. These values indicate the probabilities of the occurrence of correlation purely by chance.

4/ Probability of occurrence of the correlation purely by chance too small to be read from the table. The indications are, therefore, that the correlation is very highly significant.

Measures of standard error and probable error have not been used in the interpretation of the calculated coefficients of correlation. The usefulness of these measures is rapidly waning, due partly, perhaps, to the possibility that their application has been abused. Standard errors of correlation coefficients derived from small samples are frequently misleading because the principal value of the correlation coefficient is in its application to the analysis of problems about which little is known, and for the study of which there are only relatively small amounts of data. As Dr. Fisher tells us, it is not true that valid conclusions cannot be drawn from small samples.

The probable error is equal to the product of the standard error and 0.67449. As a test of significance a deviation three times the probable error is equal to a deviation of about twice the standard error. It is stated by Dr. Fisher that "the common use of the probable error is its only recommendation." In any instance, the desirability of calculating probable and standard errors for use as tests of significance is determined by the ability to decide whether or not they will furnish the needed indications of importance to be attached to results. The successful use of these measures in the analysis of large masses of data is not necessarily to be construed as an implication, therefore, that they can be used in formulating proper conclusions from the analysis of a small number of observations.